Reactivity of Organics and Radical Production in Continental Plumes and the Distant Mid-troposphere

Robert B. Chatfield, PI, Hanwant B. Singh, Earth Sciences Division, NASA Ames Research Center, Moffett Field, CA, USA
Ian Folkins, Dalhousie University, Halifax, Canada

Collaborators:
Kenneth Pickering, Laboratory for Atmospheres, NASA Goddard Space Flight Center, Greenbelt, MD

Summary:

We will use photochemical point trajectory-chemistry and statisitical models to rationalize and check directly the current understanding of the chemical processes producing hydroxyl radical and ozone in (a) distinct urban and industrial plumes compared to other continental pollution sources, (b) the outflow from Mexico City, and (c) possible distant continental plumes sampled in the mid-Pacific. Our analysis will focus on INTEX-A (2004) and INTEX-B (2006) periods, beginning with fresh mid-latitude plumes, then making further investigations as such plumes disperse into the great Northern Hemispheric aged-pollution mix. Trajectory and three-dimensional model results may be compared: the latter incorporate both real and unintended (strictly numerical) mixing. In the course of this, we will investigate the actual role of acetaldehyde in the free troposphere, making detailed cross-checks with other chemical species. For example, we will test the consistency of acetaldehyde measurements using measured estimates of its products, the peroxy acetyl radical, peroxy acetyl nitrate (PAN), and formaldehyde. Radicals control and are influenced in turn by nitrogen oxide (NO_x-NO_y) and peroxide balances, and the repercussions of these will also be examined, especially in concentrated plumes and very old plumes. Such work help advance our primary activity: the radical activity of plumes will be evaluated, and hypotheses will be raised regarding a major question: why do some distant plumes appear to show increasing ozone concentrations in route, and others appear less photochemically active?